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Nutrition Education for Preschool Age Children: A Review Of Research

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NUTRITION EDUCATION FOR PRESCHOOL AGE CHILDREN: A REVIEW OF RESEARCH

Susan Sharaga Swadener, Ph.D., R.D.

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U.S. Department of Agriculture
Food and Consumer Service
Office of Analysis and Evaluation
3101 Park Center Drive
Alexandria, VA 22302

Project Officer: Jill Randell

BIODATA

Dr. Susan Sharaga Swadener is a nutritionist and registered dietitian in private practice on the Central Coast of California in the community of Los Osos. She co-facilitates compulsive eating recovery groups with a psychotherapist and has recently written and recorded an audio tape on compulsive eating for continuing education units for health professionals. Dr. Sharaga Swadener is a consultant for Central Coast Neurobehvior Center, Tri-Counties Regional Center for the Developmentally Disabled, is a nutrition lecturer for INR and lectures to health professionals, is on an advisory panel for the primary prevention of childhood obesity for the Maternal and Child Health Bureau, member of the San Luis Obispo County Eating Disorder Coalition, as well as counsels private patients. She has taught Community Nutrition at Cal State, Los Angeles, trained medical students, family practice residents, and pediatric residents through a grant at U.S.C. Medical School, consulted with the U. S. Department of Health and Human Services and the California State Department of Education. She has worked with developmentally disabled children, adults and high risk infants since 1975. Dr. Sharaga Swadener obtained her M.S. and Ph.D. in nutrition from Cornell University. Her doctoral thesis was titled, *The Effect of Television Advertising on Children's Nutrition Attitudes, Nutrition Knowledge and Eating Habits*. She was a project director for a nutrition education mass media campaign in South Central Los Angeles designed to lower the incidence of developmental disabilities.

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EXECUTIVE SUMMARY

In 1969 the White House Conference on Food, Nutrition, and Health designated nutrition education for young children and pregnant women as areas of high priority for our nation because of the severe consequences of hunger and malnutrition of these two groups. Twenty-five years later anemia, obesity, dental caries, prevention of heart disease and growth retardation are still nutritional concerns of preschool age children. Nutrition education is essential for preschool children because the quality of their nutrition has a direct impact on their growth and development as well as their nutritional status throughout life. The early years in a child's life are critical ones to the formation of health promoting nutritional concepts and behavior.

Children have much to learn about food and nutrition, they are not born with a natural ability to choose a nutritious diet. They learn from familiarity through exposure to numerous foods. Reaching children at this age is important because it is easier to encourage healthy habits during initial behavior development than to alter existing behavior (Vance 1973). The ultimate goal of nutrition education for preschool age children is that they learn that a well-balanced diet contains a wide variety of foods. Most nutrition education for preschool age children takes place in the home, preschool, day care center and through television. However, many children reported that they learn more about nutrition in the supermarkets than they do at home (Colleta and Farris in Hertzler 1990).

When Head Start was established in 1965 one its goals was to improve the nutritional status of children through meals and snacks served at the Head Start Centers and through nutrition education programs for children and parents. At Head Start, meal times and food are part of the total educational process. In 1977 the Congress enacted the Nutrition Education and Training (NET) Program, Public Law 95-166, an amendment to the Child Nutrition Act of 1966. This program was created to help bring disease prevention and health promotion effort into school and childcare settings. Its basic mission was to provide an opportunity for students to acquire knowledge, attitudes and behavior necessary to make informed and healthy food choices. One of the most important results of the NET Program was the creation of nutrition curriculum and nutrition education materials for preschool and school age children. Other nutrition education programs for preschool children can be found in health clinics and at Special Supplemental Food Programs for Women, Infants, and Children (WIC).

Television programs like Sesame Street, Barney & Friends, and Mister Rogers include songs, jingles, and skits that communicate the importance of eating a variety of food for good health as well as teaching about specific foods. McDonald's and the Society for Nutrition Education are currently sponsoring Public Service Announcements (PSAs) about healthy eating Saturday mornings on CBS. Early in 1995 KIDSNET will launch its "Kid's Label Literacy Campaign". This program will promote awareness and understanding among young children (ages 4 to 10 years) about the new food label. In television public service spots *Curious George*, the monkey, will encourage children to investigate sources of information about food. A companion booklet for parents and educators will reinforce the electronic messages. These PSAs will be broadcast on the national, public and cable networks.

Nutrition education goals should be geared specifically for preschool age children. Many of these existing goals are part of the nutrition education goals in the curriculum of preschool programs such as Head Start and Nutrition Education Training Program (U.S. Dept. of H.H.S. 1992 and St Pierre and Rezmoviz 1982). The official goals of Head Start and the NET Program include:

* creating a positive attitude toward food,

* encouraging acceptance of a variety of healthful foods,

* improving children's values and attitudes related to acceptance of a variety of nutritious foods,

* promoting an understanding of the relationships between food and health,

* providing foods that contain adequate, but not excessive, amounts of energy nutrients,

* fostering the development of healthy food habits in children,

* improving parents', teachers', administrators' and food service personnel's knowledge of the principles and practices of nutrition,

* developing, promoting, disseminating and/or evaluating nutrition education curricula and materials.

In order to successfully achieve these above goals it is essential that one:

* involve parents as the major recipient of the program or in conjunction with the child,

* create and use a developmentally appropriate learning experience for the child,

* use activity-based programs (art projects, songs, jingles, puzzles, cloth food models, role playing, games, field trips, magic tricks, dramatic presentations, stories, puppets, pictures and felt boards, and computer lessons),

* use food-based activities (vegetable and fruit gardens, food preparation, tasting parties, engaging the five senses with food, and eating healthy meals and snacks with peers and adult role models).

Factors that are necessary for successful implementation include:

* integration of preschool nutrition education programs into early childhood curriculum,

* designing nutrition education programs that are easy to understand and affordable,

* teachers that are well-trained and confident in their abilities to communicate this information.

Thanks to the NET Program many preschool nutrition curricula and nutrition education materials have been developed. Unfortunately many of these programs have not been evaluated formally. Evaluations need to be integral parts of these programs. Bredbenner (1993), Hunsley (1982), and Kalina, Phillips and Minns (1989) believe that the programs that they evaluated needed to be conducted for longer periods of time in order to be seen as effective. In addition, longitudinal studies need to be conducted to measure the long term effects of the various preschool nutrition education programs. Longitudinal studies are desirable because change in behavior usually occurs more slowly and would more likely be detected when evaluated in this manner.

More studies are needed to determine what is the most effective way to reach the nutrition education goals for this age group (i.e. preference for nutritious food). Hertzler (1990) believes that we need to develop materials and activities that include problem solving skills so children will ultimately learn to select appropriate foods.

Many preschool teachers and day care operators need to have a better background in childhood nutrition. More training needs to be provided for the staff in preschools and day care centers. Staffing is often a problem in offering nutrition programs and this problem could be solved by the use of professionals as volunteers, nutrition consultants, and parent volunteers. The role of the father, older siblings, grandparents, and other extended family on the child's nutrition knowledge and eating behavior should be explored further. The caretaker role is often shared, especially in households in which the mother works outside the home. Thus, other family members may have more responsibility in the area of feeding and nutrition education. Potentially eligible families that do not participate in Head Start and other preschool programs need to be studied so they can be reached and encouraged to participate in nutrition education programs.

New and different approaches of communicating nutrition messages should be investigated. Children's television shows need to communicate more positive nutrition messages. More PSAs should be aired to counter the effects of the sugary, salty, and fatty foods advertised on children's television. The supermarkets need to be utilized in communicating healthier messages about food. The production of toys and CD-ROMS that make a positive impact on preschool children's nutrition knowledge and attitudes should be encouraged. Due to the paucity of studies in this area, more research needs to be conducted on the effectiveness of preschool nutrition education. By increasing the research for this age group we can learn what is effective and then design programs that will meet the goals that have been advocated by Head Start and the NET Program.

INTRODUCTION

Overview of Research

According to Brun (1981) attention to the evaluation of nutrition education before 1940's was limited. About 80% of nutrition education studies conducted from 1900 to 1984 were done after 1970 (Kalina, Phillips and Minn 1989). Prior to the 1960's there was more emphasis on health status of the child. Early program successes were measured in terms of defects corrected, gains in weight and physical improvement. Changes in weight, height, skinfold thickness, blood chemistry, and other anthropometric indicators were emphasized. Many early nutrition education programs focused on the underweight child which is still a major concern in developing countries. There was less emphasis on increasing the child's nutrition knowledge and changes in food habits.

In 1969 the White House Conference on Food, Nutrition, and Health designated nutrition education for young children and pregnant women as areas of high priority for our nation because of the severe consequences of hunger and malnutrition on these two groups. In the 1960's and 1970's researchers were looking at the factors that could be used to increase preference for previously rejected or unfamiliar food (Harill, Smith and Gangever 1972, Ireton and Guthrie 1972, Karsch 1977, Lamb and Ling 1946, and Witherall 1978).

In the late 1960's and 1970's we saw a trend in more research being conducted that measured nutrition knowledge, food preferences and eating habits. Olson and Randell (1981) in their review report that Juhas and Ferrira found that nutrition education activities that offer children first-hand experience, active participation, and a non-threatening environment were most successful. They report that not all nutrition activities had to involve eating food. Preschool teachers are puppet makers, story tellers, and creators of games and songs that have successfully promoted food and nutrition (Smith 1976). Ferreira (1973), Karsch (1977), Placek (1976) and Withererall (1978) observed that parental involvement and parental education were essential components of a successful nutrition education program for preschoolers. The research conducted from 1980 to 1994 has continued the emphasis on increasing children's nutrition knowledge and preference for healthier foods, especially snacks. In 1977, Congress enacted Public Law 95-166 (an amendment to the Child Nutrition Act of 1966) which created the Nutrition Education and Training (NET) Program. This has resulted in an increase of development of nutrition education curricula for preschoolers. There are more experiential activities, with more hands on opportunities and the use of the five senses in relation to food and health. Meal and snack times are being utilized as a learning experience for good nutrition and food choices that are more in line with the *Dietary Guidelines.*

We are seeing more and more parent involvement in preschool nutrition education programs. Essa, Read, Haney-Clark (1988) have done research on enhancement of preschool

curriculum at school by designing a curriculum for home use to reinforce the school-based program. Lee, Schvaneveldt and Sorenson (1984) have conducted studies evaluating home-based nutrition curriculum for preschool children. Parental involvement has been shown to enhance learning since families are a major source in determining whether or not children learn successfully. When parents are involved they can manage and generate new ideas, get an opportunity to learn about nutrition, see what their children are doing at school and can reinforce the learning at home. Most of the research involves just the mothers, but the fathers are very important in shaping children's food preferences and eating habits. The PEP study (Leonard, D, Augelli and Smiciklas-Wright 1984) looked at both parents' influences on eating habits in relationship to preventing obesity and demonstrated that the intervention increased the fathers' promotion of healthful eating habits. Much has been learned about young children's food preferences from the research of Birch and her associates (1980, 1982, 1984, 1987 and 1994).

Mass media is a very powerful and appropriate tool for making differences in preschool nutrition education. Unfortunately, we know the negative effect of TV ads have on the desire for sugary, salty, and fatty foods by young children. Food companies spend billions of dollars advertising these unhealthy foods and it is difficult to counter their effects with a few PSAs for eating nutritious foods. KIDSNET is conducting a project geared to children from four to ten years of age. They are producing PSAs that will help children understand the new food label and how to make good food choices. Also educational materials are being designed for parents and teachers. The Children's Television Workshop which produces Sesame Street constantly gives positive messages about foods but they have not measured the impact of their nutritional messages (Lovelace 1994). Since March 1994 McDonald's and the Society for Nutrition Education have been producing one minute PSAs on healthful eating, seen Saturday mornings on CBS. Their program "What's On Your Plate" includes an activity brochure, a leader's guide and a video for health professionals to use in schools and other non-Saturday morning TV viewing settings. This program is aimed at two to eleven year olds and it will be evaluated at a later date.

Recent research on preschool nutrition education has concentrated on the effects of nutrition curricula that are being used in preschools and day care centers. These evaluations have been designed to measure increases in nutrition knowledge, changes in food preference and eating habits and nutritional health or status. The research done in developing countries often includes the nutrition education component as part of a food supplement or health care services. Impact on nutritional status is frequently the primary measurement in these countries.

Overview of Programs Providing Nutrition Education to Preschool Children

Head Start

Project Head Start was established in 1965 to overcome the emotional and intellectual deficiencies in preschool age children of poverty (Cross, et. al.1984). Head Start provides a child development program for lower-income preschool children and includes nutrition services

in the program's health component. Initially nutrition services came from volunteers and contracts with professional organizations. The Food and Nutrition Service of the USDA contracted with Head Start to introduce the Child and Adult Care Food Program (CACFP). The CACFP reimbursed meals and supplements for Head Start children and established guidelines that nutritious foods based on the *Dietary Guidelines* be served. Food service specialists from the USDA and state education departments were made available.

As Head Start grew and expanded administration of the nutrition program, food service, and nutrition education were refined and expanded. The Self-Assessment Validation Instrument was used by administrators to identify whether or not areas were in compliance with federal standards and to implement a process to correct them through self-assessment or through validation by a Head Start team of consultants. Another way that nutrition services were strengthened was by the development of Head Start Nutrition Performance Standards which established practical guidelines for the qualifications of nutrition and food service staff, the responsibilities of nutrition personnel, and for the nutrition education of staff and parents, infants and preschoolers, and children with special needs (U.S. Dept. H.H.H. 1984).

A major nutrition goal of the Head Start program was to improve the nutritional status of children through meals and snacks served at the Head Start Centers and nutrition education programs for children and parents (U.S. Dept. of H.E.W. 1975). Since its beginning Head Start has recognized that early experiences with foods are important in forming life-long attitudes that affect health and well-being (Byrd-Bredbenner, Marecic, and Bernstein 1993). Meal times and food are part of the total educational program. The teaching of good food habits through nutrition education is facilitated by teachers and food service personnel working together to coordinate the nutrition lessons with the meals and snacks that are served to the children. The feeding program is an integral part of the nutrition education program. The nutrition component, while providing for the child's nutritional needs, allows for:

* building children's self-esteem through serving cultural and ethnic foods, allowing choices, encouraging children to make decisions related to quantities of food taken, and serving their own food,

* introducing a variety of unfamiliar nutritious foods and providing the opportunity to build good food habits and attitudes,

* demonstrating that mealtime is a pleasurable and enjoyable experience for socialization as well as eating,

* providing learning experiences through participation in mealtime activities such as setting the table, preparing food, cleaning up and serving food,

* developing muscle coordination and decision-making skills by allowing the child to prepare food and serve family style.

(U.S. Dept. H.H.S. 1992)

The Head Start Nutrition Education Curriculum: *Children, Get A Head Start On The Road To Good Nutrition* has been specifically written for children ages three, four and five years old who are participating in the National Head Start Program. This curriculum is a comprehensive approach to the development of positive food habits in preschool children by promoting experiences using a wide variety of foods. The unique features of this curriculum are its: multidisciplinary approach, multicultural diversity, teaching ease and self-contained lessons (U.S. Dept. H.H.S. 1992). *Children, Get A Head Start On The Road To Good Nutrition* has been organized into nine units (Food Makes Me Me, Planning to Feed Me, Clean Eating, Variety Surrounds Me, Food is Sens-ational, Food Origins, Body Building Basics, Eating the Basic Way, and Special Occasion Foods). Each unit contains seven to twenty-nine lessons. Each lesson has a subject matter emphasis in addition to nutrition (reading readiness, language development, basic mathematics and motor skills). Each lesson has a technique for immediately measuring what a child has learned and determines whether the goals have been met.

Bryd-Bredbenner, Marecic and Bernstein (1993) studied the effects of six weeks of a sampling of lessons from *Children, Get A Head Start On the Road To Good Nutrition*. They found that the children who were exposed to the curriculum refused less of the foods served at the Head Start Program and increased their requests for low-sugar snacks. Gunn and Stevenson (1985) and Koblinsky, Guthrie, and Lynch (1992) have also found that Head Start nutrition education programs have made an impact on the nutrition knowledge and eating habits of children and parents participating in the programs. Phillips (1993) states that the research on nutrition education in Head Start program has shown that it is important to:

* relate nutrition learning activities to real life situations,

* share nutrition education objectives with parents and encourage them to participate as partners in the learning process,

* develop ongoing nutrition education programs for staff members,

* involve the community in nutrition activities,

* consider the child's stage of growth and development.

Nutrition and Education Training (NET) Program

In 1977 Congress enacted the Nutrition Education and Training Program, Public Law 95-166, an amendment to the Child Nutrition Act of 1966. This program was created to help bring

disease prevention and health promotion into school and child care settings. The legislative purpose of the NET program was to "encourage effective dissemination of scientifically valid information to children participating or eligible to participate in the school lunch and related child nutrition programs" (Kalina 1989).

The NET Program is administered nationally by the USDA through a system of grants to state education agencies for appropriate training of educational and food service personnel and for the conduct of nutrition education activities in school and child care institutions. The major NET program goals, which the legislation requires the states to address include:

* the instruction of students, pre-school through grade 12, in the nutritional value of foods and the relationships between food and health,

* the training of food service personnel in nutrition, food service management, and the use of the school cafeteria as an environment for learning about food and nutrition,

* the inservice education of teachers and other school staff in nutrition education and in the use of the cafeteria as a learning laboratory,

* the identification, development and dissemination of nutrition education resources and curricula. (Kalina 1989)

The NET Program does not specify a particular model of nutrition education for use on a national basis, but instead the state education agencies develop individual state-level programs. This type of set up does not facilitate the evaluation of the NET Program on a national basis. Counts of the number of children, educators, and food service personnel receiving nutrition education training are the only statistics currently being submitted to the USDA by all state and territorial NET Programs. Abt Associate Inc. did a national study of the NET Program's effectiveness between 1979 and 1980 under contract from the USDA. St Pierre and Rezmovic (1982) found that the programs had a large positive effect on children's program-related nutrition knowledge. They found some positive effects on willingness to select and taste new foods, on reported food preferences, and on food-related attitudes. The behavioral and attitudinal effects were neither as strong nor as consistent across grades and programs as were the effects on knowledge. However this evaluation did not report on findings on preschool and day care programs. Unfortunately, the reduction of federal funding has adversely affected the program's evaluations. Kalina (1989) reported that in many states evaluation activities have had be sacrificed altogether in order to maintain a minimum level of service.

Special Supplemental Food Programs For Women, Infants and Children

The Special Supplemental Food Programs For Women, Infants, and Children (WIC) was established by Congress to provide supplemental food to low-income pregnant or lactating women and their young children who are nutritionally at risk. In addition to food, the WIC program also provides nutrition education for the families and encourages the appropriate use of prenatal and other medical services (Smith et. al. 1986).

Nutrition education is available to all adult WIC participants, to parents or caretakers of infant and child participants, and whenever possible, to the child who participates. The goals of WIC nutrition education are:

* to teach the relationship between proper nutrition and good health,

* to help the individual at nutritional risk to develop better food habits,

* to prevent nutrition-related problems by showing participants how to best use their supplemental and other foods. (Owen and Frankle 1986)

Barbara Mayfield (1993) has created *Kids Club: Nutrition Learning Activities for Young Children*. Her program was created for preschool age children enrolled in WIC. *Kids Club* can also be used with children in Head Start, EFNEP, child care, preschool, kindergarten and early elementary school. The curriculum consists of a song book, a tape cassette of 34 songs, 6 puppets (Wicky Waccoon, two Kid's Club Cubs, Picky Piggy, Nutrisaurus, and Candy Man Crocodile), and a teaching manual of 26 lesson plans and supplemental activities. The lessons include:

* Basic nutrition - variety, balance, moderation,

* WIC food and friends - milk, juice, eggs, beans, peanut butter, grains, fruits and vegetables,

* Eating habits - new foods, breakfast, good snacks, mealtime manners,

* Food from farm to table - experience growing foods, shopping for foods, preparing foods,

* Taking care of my body to grow and stay healthy - proper hygiene, dental care, good eating, growing, exercise, and health habits.

Smith et. al. (1986) looked at the effectiveness of Special Supplemental Food Programs for Women, Infants and Children for mothers and their anemic children under 5 years of age. They found that the participants in WIC had an increase in their knowledge of each subject presented in the nutrition education classes.

Piagetian Theory and Preschool Nutrition Education

Piaget has provided us with one of the best descriptions of how children think and characteristics of their thinking at different stages of their development (Smith 1989). Each stage represents a different kind of thinking from the previous stage. Piaget describes children from two to seven years in the preoperational stage. During the preoperational period the child evolves from one who functions primarily in a sensori-motor mode (birth to two years) to one who functions in a conceptual-symbolic mode (Wadsworth 1974). The child becomes increasingly able to think and becomes less dependent on his direct sensori-motor actions for direction of behavior. However, a child at this stage has not developed the ability to think logically or abstractly; reasoning is unsystematic and does not lead to generalizations or formation of logical concepts. This occurs because thinking is bounded by perception, egocentrism, inability to attend to transformations, centration, irreversible thought, and the inability to conserve (Wadsworth 1974).

Piaget believed that the child at two to seven years old learns by manipulation of the environment rather than by passive listening (Wadsworth 1974). Preoperational children are exploring, manipulating, questioning, comparing, contrasting, labeling and forming mental images. These activities lay the foundation for the development of the child's ability to think logically.

According to Piagetian theory, nutrition education for this age group should involve activity-based teaching and teach strategies that encourage interaction with real world objects (i.e., food). Abstract concepts outside the realm of immediate experience should not be included in preschool nutrition education since children at this stage of development cannot observe these concepts and thus find them incomprehensible. *Nutrients* may be seen as an abstract concept to preschool age children (Contento 1981). We need to find ways to teach abstract concepts as *nutrients* in meaningful ways that will have an impact on their food choices.

Nutrition educators must be aware that the preoperational child is perceptually oriented and often classifies on the basis on how things look or how they are used (Contento 1981). This is important when teaching children to classify foods into groups. Asking preschoolers to classify foods into a protein group may cause difficulties because the concept of *protein* is an abstract one for the preoperational child. The appearance of the food may be more important in classifying. According to Piaget and his followers, most children do not master the subtleties of classification until they enter the concrete operational level at approximately age seven (Gorelick and Clark 1985). So nutrition educators will need to experiment with different food group systems that are more perceptually based and less dependent on formal structures.

Another important teaching of Piaget is that experiences build upon each other (Wadsworth 1974). Children must actively relate something new in their experience to experiences previously encountered, assimilated and stored as mental structures or understandings (Wadsworth 1974). Curricula need to be developed with this thinking in mind.

Children will not learn if they do not have the prerequisite skills. If the curricula do not take into account the children's level of conceptual development, it is not going to work. When nutrition education curricula are designed it is necessary to take these ideas into consideration and be more child-centered and activity-based. Piaget and his colleagues emphasized the importance of studying the learners themselves if one wants to find out how learners learn. Based on findings that young children's understanding of what happens to food in the body and related nutrition concepts are different from adult understanding, Contento (1981) urged that curriculum developers and teachers should more frequently ask children themselves what they eat and how they make their food choices. This information can then be used to provide nutrition education that is relevant from the perspective of the child.

Piaget advocated education that is active (Chattin-McNichols 1992). He emphasized the importance of experiences with concrete objects. Development cannot be taught and education must be guided by the way the child thinks and by natural laws of development (Wadsworth 1974). These teachings of Piaget and his followers need to be incorporated into our thinking when we design nutrition education curricula and programs for preschool age children. Many times there is no change in nutrition knowledge or eating habits because the program has been inappropriate for the developmental stage of the child. This information needs to be communicated in a way that is meaningful for the preoperational child.

The Importance of Familiarity/Exposure on Food Acquisition Patterns

Leann Birch has conducted a wealth of research on young children's food preferences. She states that the most important finding in the ten years of research that she conducted at the University of Illinois, "is that early experience with food and eating is crucial in the development of food acceptance patterns, both in terms of the acquisition of food preferences and the regulation of food intake" (Birch 1987). Birch (1987) has observed that there are several ways in which everyday experience with food and eating can have an impact on food acceptance and intake. These include:

* the frequency of exposure to food,

* associative conditioning of food cues to physiological consequences,

* associative conditioning of food cues to social context,

* learning which of many cues available (physiological, environmental, cognitive) are relevant in the initiation, maintenance, and termination of eating.

Children are born with a preference for sweets and the rest of preferences are learned (Birch 1994). Unlike sweetness, familiarity is not an intrinsic characteristic of a food, but is a function of the individual's exposure to experience with that food. When discussing food preference of

preschool age children it is essential to mention the neophobic response which is frequently seen in young children. It is a natural and protective mechanism; however, it is one of the most common reasons for food rejection. Birch (1987) studied children two to three years, three to four years, and five to six years. The younger children were initially more reluctant to taste the new or unfamiliar foods; however, it was observed in all the age groups studied that preference increased with exposure. The relationship between number of exposures and preference was much stronger when the foods were tasted, not just looked at.

Association of food cues with physiological consequences of eating is important in the acquisition of food acceptance patterns. Birch's (1987) research on conditioning of satiety found that even very young children are able to regulate intake based on their physiological reactions to foods (satiety). Association of food cues to social context of feeding has been studied by Birch and her associates. They have found that the specific type and emotional tone of the social interactions that surround feeding influence the acquisition of children's food preferences. If a food is paired with a reward, she found that one gets a dramatic increase in preference ("If you get dressed you can get ice cream"). The opposite occurs if you use a food to obtain a reward ("Eat your peas and you can watch television later"). The food used to obtain a reward is even more disliked after this association (Birch, Marlin and Rotter 1984, and Birch 1994).

Eating is a social experience and the eating behavior of others can serve as models which could have an impact on the young child's preferences. Birch (1980) looked at the effect of peer models on the food choices and eating behaviors on preschoolers' preference for vegetables. She found that exposing preschool aged children to peer models who were selecting and eating the target child's nonpreferred food item was sufficient to cause the child to choose the non-preferred food even in the presence of an initially highly preferred food. Birch concluded that young children's experience with food does not occur in a vacuum but in a social context.

REVIEW OF STUDIES

Data Sources Searched and Number of Studies Reviewed

The author of this paper conducted computer searches of AGRICOLA, CRIS/USDA, ERIC, AND MEDLINE databases. A manual search was made of *Nutrition Abstracts, Journal of the American Dietetics Association, Journal of Nutrition Education, Nutrition Today, American Journal of Public Health Association* and the *Journal of Home Economics.* These searches were conducted for the years 1980 to 1994. Twenty-eight studies met the criteria for following scientific experimental design. Forty-one other articles which reviewed other studies, summarized research findings or described nutrition education programs were also included. Several nutrition educators and researchers were contacted by telephone (Katherine Brieger, Carol Byrd-Bredbenner, Sari Edelstein, Mary Goodwin, Ann Hertzler, Barbara Mayfield, Eunice Romero-Gwynn, and Barbara Shannon) as well staff at the Maternal Child Health Bureau, the California State Department of Education, the American Dietetic Association, the Society for Nutrition Education, Head Start, KIDSNET, McDonald's, the Children's Television Workshop, and the California State WIC program.

Nutrition Education and the Preschool Child

The preschool child

Children at this age are developing their thinking skills. Language is developing very quickly. They are beginning to understand symbols and socialization (Debord and Hertzler 1993). Skills are being developed when children touch, feel, look, mix-up, turn over and throw. Exploration and the need to test independence seem to dominate during this time. Independence is the primary emotional stage during the early preschool years. Learning to be independent paves the way for the child to develop a healthy sense of initiative drive or motivation (Debord and Hertzler 1993). A preschooler is taking on more initiative and is out to learn and be more purposeful. In these stages of learning the preschoolers are making a point of learning from other people. They observe, they role play and start to accumulate and process information (Satter 1987). Thus a preschooler is capable of observing what parents, teachers, and other children eat and is being influenced by them. Developmentally it is a good time to introduce new foods and knowledge regarding food and health.

The importance of nutrition education for preschool age children

The early years are the most important years for nutrition education because it is during this period that lifetime eating habits are formed. According to Vance (1973) , "it is often easier to encourage healthy habits during initial behavior development that to alter existing behavior". Nutrition education should begin in an effort to positively influence a child's eating habits, habits that will hopefully last into adulthood. Children can very early develop awareness of the relationships among good eating habits, good nutrition and a healthy body (Battle and

Blackwell 1981). Lee, Schvaneveldt and Sorenson (1984) state that the early years in a child's life are critical ones to the formation of health promoting nutritional concepts and behavior.

Nutrition education is so important to two to five year olds because the quality of their nutrition affects their growth and development. These positive food practices and attitudes that are established during the early years are believed to affect food choice and consequently nutritional status throughout life (Hunsley 1982). Olson and Randell (1981) have pointed out that these early food habits can have a lasting effect on health considering the role of diet in tooth decay, obesity and cardiovascular disease.

Unfortunately children have much to learn about food and nutrition. They are not born with the ability to choose a nutritious diet. Birch (1994) has found that children have an innate preference for sweet foods and the rest of preferences are learned. Nutrition education is an integral part of improving the nutritional status of young children and educating them to eat, enjoy, and ask for foods that meet their needs (Hunsley 1982). Learning how to choose and enjoy many different foods in early childhood can help to provide the foundation for a lifetime of wise food choices (Farthing 1987).

Effectiveness of Nutrition Education Program for the Preschool Child

Environments for nutrition education of preschool age children

The majority of nutrition education for preschool age children takes place in the home, preschool or day care center. However, many preschoolers report that their major source of nutrition education occurs in the grocery store and fast-food restaurants (Coletta and Farris in Hertzler 1990).

Preschoolers' thinking about nutrition and their related behavior

Singleton, Achterberg and Shannon (1992) studied the role of food and nutrition in the health perceptions of sixty children, four to seven years of age. They used a pretest/posttest experimental design and randomly assigned children to experimental and control groups. The experimental group completed a four week home-based nutrition education program. They found that the nutrition education intervention significantly increased the children's perception that health and nutrition were related concepts. This was accomplished by using closed-ended questions scores and concept map scores.

It is important to know that preschool age children make food selection decisions more often at breakfast and snack periods then at other times (*Preschool Nutrition Education* in Hunsley 1982). Klesges et. al. (1991) observed that young children do not independently choose nutritious foods. Without proper nutrition education and intervention from their mothers, they tend to choose foods high in sodium, salt, sugar, fat, or those that are familiar to them.

Concept and nutrition knowledge that preschoolers are capable of learning

Hertzler (1994) has stated that "Too often preschoolers are simply entertained because they are assumed to be unable to learn". Preschoolers are curious and they want and need opportunities to learn about nutrition. It has been reported that preschoolers can learn the names and sources of different foods, the need to eat a variety of foods, that some foods are healthier for them than others, and that foods have different textures, shapes, colors, smells and tastes (U.S. Dept. H.H.S. 1992). Gorelick and Clark (1985) have noted that three to five year olds can easily learn to identify foods. Singleton, Achterberg and Shannon (1992) have shown that children four to seven years old possess the ability to comprehend abstract concepts such as energy, a strong heart, that good foods keep germs out of the body, and that low fat keeps the heart healthy.

The research of Lee, Schvaneveldt and Sorenson (1984) show that preschool aged children can have a conceptual understanding of nutrition that goes beyond the names and tastes of food. They found that preschool age children can comprehend the concepts of nutritive value, nutrient function and the impact of nutrition on health. Lee, Schvaneveldt, and Sorenson (1984) used a pretest and posttest model with two treatment groups (one taught by parents and the other taught in a child development lab) and a control. Each group contained 20 children who ranged in age from three-and-one-half to five years old. They used *Food Profile Cards* which displayed a picture of the food, its name in large type, and color-coded graph bars for vitamin A, vitamin C, iron and calcium. Contento (1981) studied thirty-four children ranging in age from five to eleven years old. The subjects were classified into preoperational and concrete operational stages on the basis of two standard Piagetian tasks. Contento (1981) found that eight out of ten of the preschool age children were preoperational and did not view food as becoming part of the body. Although the children heard nutrient terms such as protein or vitamins before, the results of her study indicated that they saw no connection between the concept of nutrients as components of food and their personal experience of the eating process and the effects of food on their bodies. These two studies appear to have conflicting results. Perhaps the children in Lee, Schvaneveldt and Sorenson's study could understand nutritive value, nutrient function and the impact on health because these ideas were communicated in a concrete manner (use of *Food Profile Cards* with bar graphs) and was therefore developmentally appropriate.

Parents' influence on nutrition knowledge of preschool age children

Parents play a major role in the nutritional care and education of children early in the child's life. Anliker et. al. (1990) was interested in the ways in which parents communicate with their preschool children about food and nutrition and its effect on their nutrition knowledge. She discovered that the more information was communicated and the more specific that it was, the more knowledgeable those children were about nutrition concepts. Positive nutrition messages (why food is important) had a greater impact than negative messages (why one should not have a food) on nutrition knowledge scores.

Effect of parents' involvement with nutrition curriculum on knowledge gain

Parental involvement has been shown to enhance learning (Essa, Read, and Haney-Clark 1988). Families are a major source in determining whether or not a child will learn successfully. Singleton, Achterberg and Shannon (1992) studied the effect of a four week home-based nutrition education program using audio cassettes and picture books. They found that the treatment group significantly increased their perception that health and nutrition were related topics. Another important finding was that a change in knowledge was only seen using open-ended questions (concept maps). These concept maps are a form of content analysis or a means of analyzing text. They are two-dimensional schematic presentations that depict relationships among concepts (in the form of propositions) held by individuals. For example "food is fresh" represents a proposition linking the two concepts "food" and "fresh". Concept maps depict a set of concept meanings contained within a framework of propositions. The use of close-ended questions showed no difference as a result of the educational intervention.

Lee, Schvanveldt, and Sorenson (1984) compared an eight week nutrition instruction program using a pretest, posttest, and control group experimental model. Twenty children were taught in a child development lab, twenty were taught at home, and twenty children served as a control group. It was found that the children taught in the classroom learned significantly better than those taught at home. The researchers concluded that this occurred because they needed to more systematically train the parents.

Essa, Read, and Haney-Clark (1988) looked at the effect of parent augmentation on a ten week preschool curriculum taught at school. They studied three groups of preschool aged children. One group (22 children) was exposed to the curriculum along with parent augmentation of the curriculum content at home. The second group (23 children) participated in the curriculum at school but the parents were not involved and the third group (15 children) served as a control and did not receive any instruction. The group of children who were exposed to the school curriculum with a parent component scored higher in nutrition knowledge than either the children just exposed to the curriculum at school and the control group. However both treatment groups scored higher than the control. This study demonstrated that parents and teachers working together make the experience more meaningful through mutual reinforcement.

Nutrition education curriculum in a preschool or day care setting

Davis et. al. (1983), Gorelick and Clark (1985), Hendricks, Echols, and Nelson (1989), and Turner and Evers (1987) conducted research in the classroom setting measuring the effect of nutrition education program on nutrition knowledge.

Davis et. al. (1983) developed a curriculum guide on nutrition for preschool children. The activities included group-time action stories, songs and self-selected activities involving food. Sixteen preschools used eight activities per week for six weeks. The children were pretested and posttested (there was no control group). They found a significant increase in nutrition knowledge but no difference in food behavior (tasting foods).

Gorelick and Clark (1985) designed a nutrition curriculum for preschool age children. They studied a total of 187 children ranging from three to five years of age from fourteen schools (twenty classrooms). They randomly assigned classes to one of four groups for pretesting, intervention, and posttesting. Each group consisted of forty-seven children except one group had forty-six children. Only one control group and one treatment group were pretested to guard against test-wiseness. All groups were posttested. Twelve nutrition education activities (twice a week for six weeks) was presented to the two treatment groups. The children exposed to the nutrition activities had higher posttest nutrition knowledge scores, especially in the area of food identification. The older children scored higher in three areas (fruit identification, toothbrushing, and food choices) than the younger children. Gorelick believed that her program was a success as a result of the fact that developmentally appropriate materials were used and the activity-based learning experience (including tasting foods) facilitated acquisition of food and nutrition concepts.

Henricks, Echols, and Nelson (1989) assessed the impact of *Hale and Hardy's Helpful Hints* preschool health education curriculum on the health knowledge of children ages three to six. Nine preschool programs with 194 children comprised the experimental group and three preschool programs with 73 children comprised the comparison group. The pretest was administered in September and the posttest in April of that school year. They concluded that the curriculum had a moderate impact on children's health knowledge, including nutrition, but did not make a significant change in knowledge of feelings and emotions.

Turner and Evers (1987) looked at the effectiveness of a microcomputer lesson on food identification compared with a traditional nutritional lesson (using a puppet, picture cards and a card chart) with fifty-five preschool age children. Both teaching methods were equally effective in increasing nutrition knowledge (identification and recognition of foods). It was suggested from the data that the computer is an effective tool to engage children from the lower socioeconomic groups in learning but a lack of demographic data on the subjects precludes any definitive conclusions. However the teachers found the computer more relaxing and they enjoyed the ability to focus attention away from the materials and onto the children and the subject matter.

Effectiveness of nutrition education of food and nutrition behavior of preschool age children

A multiplicity of forces operate on a child's eating patterns. The nutrition related behavior of greatest interest to nutrition educators has been eating which directly affects nutritional status and health.

Behavioral intervention affecting food and nutrition behavior

During the preschool years children are being introduced to many foods of the adult diet, and these early experiences with food are particularly important because preferences formed during this period are assumed to persist into adulthood. Birch (1980) found that eating

behaviors can serve as models which have an impact on a young child's food preferences. She found that exposing preschool aged children to peer models who were selecting and eating the target child's nonpreferred food item was sufficient to cause the child to choose the non-preferred food even in the presence of an initially highly preferred food. In this study it was observed that if children are exposed to other children's preferences (for vegetables) different from their own, the set of foods they would learn to accept would be enlarged. These preferences endured beyond the testing situation. The endurance of the preferences showed the strength of peer modeling.

Birch and Marlin (1982) have found that food dislikes are associated with unknown and unfamiliar foods. Food rejection is associated with fear of the unknown. Results of studies conducted over ten years by Birch (1987) have shown that experience plays a major role in children's acceptance patterns. Preferences were found to be an increasing function of exposure (tasting and looking). Preference was strongest and significant only for the exposure conditions in which the children actually tasted the food, not just looked at it.

Another way to affect food preferences is by using reinforcement for trying a new food. Stark et. al. (1986) used a behavioral program to modify young children's food choices during a preschool snack period and assessed the program at school and in the home (outside of training setting). They studied seventeen children ranging in age from three years to six years. Stickers and praise were given for choosing a healthy snack and for using cueing sentences (ie. "This is a snack that's good for me, isn't?"). Stark et. al. found that the reinforcement (stickers and praise) increased healthy snack choices just at school. After withdrawal of reinforcements, the snack choices returned to baseline levels. Most likely giving a reward for eating particular food decreased the desirability for that food. Birch, Marlin, and Rotter (1984) found in two experiments that the instrumental use of foods reduces liking for the foods that are eaten to obtain rewards.

Effect of public service announcements and television ads on preschool children's food choices

Galst (1980) studied the effect of television food commercials and pro-nutritional public service announcements (PSAs) on sixty-five preschool children ranging in age from 3.5 years to 6.75 years during a four week intervention period. Galst used a pretest/posttest design with four different treatment groups and one control group. The five conditions were: (1) commercials for food products with added sugar content and no adult present, (2) commercials for food products with added sugar content viewed with adult comments, (3) commercials for food products with no added sugar content, pro-nutritional PSA and no adult present, (4) commercials for food products with no added sugar content, pro-nutritional PSA viewed with adult comments and (5) control condition. The foods advertised with added sugar included sugared cereals, candy, pop-tarts, cookies, caramel corn, fruit drinks or soda. The advertised foods with no added sugar content included apples, oranges and milk. The PSAs encouraged the consumption of fresh fruits and vegetables, dairy products, and foods from the

basic four food groups and discouraged high consumption of highly sugared foods. The dependent measure in the experiment was the weekly proportion of snacks chosen which contained added sugar content. The intervention which was most effective in reducing young children's selection of snacks with added sugar content was the presentation of commercials for food products without added sugar and pro-nutritional PSAs with accompanying positive evaluative comments by an adult co-observer. However mere exposure to the ads for foods low in sugar did not influence child's snack choice. The negative comments by the adult co-observer about added sugar snacks did not decrease the intake of these snacks at preschool.

Nutrition education intervention methods to prevent obesity

Leonard, D'Augelli and Smicilkas-Wright (1984) evaluated an education intervention program (Preschool Eating Patterns or PEP) designed to prevent weight problems in children by encouraging family changes in food selection, eating habits and activity levels. Thirty-six families with at least one preschool age child participating in the PEP program served as the experimental group and eleven families with at least one preschool age child served as the comparison group. Parents in the experimental group met weekly for five weeks in small groups of four or five families. Each group had leaders with expertise in nutrition and behavioral change and each family was given a manual. A pretest/posttest design was used. Leonard, D'Augelli, and Smiciklas-Wright (1984) observed that the families in the PEP program had more health promoting patterns, the fathers improved in verbal response to food situations and there were less negative parental verbalizations at mealtime. This educational oriented preventive strategy was successful in changing parents' behavior in the feeding situation, but further research needs to be conducted to determine if the program will change children's eating habits, food choices, and prevent childhood obesity. This could be accomplished by doing a longitudinal study.

Kleges et. al. (1991) investigated the impact of parental influences on children's selections and the impact of childhood obesity on these food choices. They studied fifty-three children who ranged in age from four to seven years of age. Thirty-seven percent of the children were classified as obese (surpassed 75th percentile of relative weight). Each child was instructed to choose any meal item for lunch and to place his or her selection on the tray. Next the same child was again asked to select a meal for lunch but was told that this time his or her mother would inspect the food selection. Then the mother was given the tray after the child was told that she would inspect it. The mother was told that she could modify the tray to create a lunch that the child might normally be served. Kleges et. al. (1991) noted that given free choice the children chose 25% of their calories from foods high in added sugar. When told that their trays would be inspected by their mothers, the children modified their intake by choosing less foods high in sugar. The change that the mothers actually made resulted in decreased calories, saturated fat and sodium. However the mothers did not add any nutritious foods but only removed foods from the trays. This study showed the strong impact that parents have on children's food selection. Also it was observed that children chose foods high in sugar, although they knew it was not a desirable food habit.

Effect of nutrition education curriculum on eating behavior of preschool age children

The Community Research Center (1980) analyzed the SPEAC (Student Parent Educator Children) Preschool Nutrition Education Project. The SPEAC program was developed to integrate the USDA Child Care Food Program and the educational curricula and activities of selected child care programs in Minneapolis during the school year of 1979 to 1980. The program was evaluated using pretest/posttest experimental design with 139 children in the treatment group and 29 in the comparison group at the end of the study. The eating behavior and receptivity to new foods by preschool children were assessed prior to the introduction of the program in the child care facilities and family day care centers. Their preferences were studied again at the conclusion of the program year. The project demonstrated that the nutrition education program (small group activities) increased the acceptance of fruits, vegetables and dairy products.

Another large nutrition education project is the *Iowa Nutriphonics* (NET Program). This project was evaluated by Hunsley (1982). She studied 850 preschoolers and their parents as well as eighty teachers in seventeen nursery schools and child care centers. A fourteen unit learning package was presented for twenty to thirty minutes three times per week. The curriculum emphasized choosing nutritious foods rather than nutrition knowledge. Hunsley (1980) did not find many differences in food choices made by children participating in the program than from the children in the control group. Although the children who participated in *Nutriphonics* increased their choice of an infrequent fruit snack (dried apple slices), there was no difference in choosing a picture potluck meal and choosing an empty-calorie or a nutritious snack. The author of the study concluded that if the project continued over a longer period of time, more changes in choosing nutritious snacks would have occurred. Hunsley (1980) came to this conclusion because there was no statistical difference between the experimental and the control group, although there was some evidence that some changes were occurring and the data was approaching levels of significance.

Effect of a nutrition education program on the nutrition knowledge, nutrition attitudes and eating habits of preschool age children

Byrd-Bredbenner, Marecic, and Bernstein (1993) created a self-contained nutrition education curriculum (*Children, Get a Head Start on the Road to Good Nutrition)* designed to encourage the development of Head Start children's nutrition knowledge and abilities. A total of 1000 Head Start children in 65 classrooms nationwide were studied. Each classroom was randomly assigned to either the experimental (instructed) or control (non-instructed group). The effect of six weeks of instruction using a sampling of the lessons in the guide on the nutrition knowledge, attitudes and behaviors of the children were investigated using a classical experimental design. Teachers in the control and experimental groups were trained in the use of the curriculum. The curriculum was very experiential and easy to use. There was no significant difference in nutrition knowledge and attitude between the experimental and control group. However children in the experimental group which used the new curriculum decreased their refusal of foods served and increased their requests for low-sugar snacks. The control

group of children increased their refusal of foods served and decreased their requests for low-sugar snacks. Byrd-Bredbenner, Marecic and Bernstein (1993) concluded that the children needed more time to internalize the concepts to see a significant difference in nutrition knowledge and attitude. The curriculum was really designed for a three year time frame and it was only studied for six weeks due to funding constraints.

Lawatsch (1990) investigated the effect of two teaching strategies, *benefit appeal* (emphasized the positive, favorable results of eating a variety of vegetables) and *threat appeal* (focused on the health and nutrition risks arising from not eating vegetables), on the nutrition knowledge, attitudes, and food behavior of 103 preschool children. The study employed a pretest/posttest design. Preschool classes were randomly assigned to a *benefit appeal* experimental group, a *threat appeal* experimental group or a control group. The experimental groups were exposed to three nutrition education presentations consisting of modified popular fairy tales that teach about the benefits of vegetables. Lawatsch found that both appeals were effective but the *benefit* group had a higher nutrition knowledge score and a higher score for vegetable snacks based on selection of vegetables from a snack tray.

Effect of nutrition education on mothers of preschool age children

Gunn and Stevenson (1985) trained ninety-five Head Start parents and fourteen staff. Staff were given four training workshops and many of them attended the parent training programs. Parents were given an introductory lecture, four workshops, twelve newsletters, cassette players and tapes of exercise/fitness activities, and planned an International Food, Fun, and Fitness Festival with staff. These interventions caused a significant increase in parents exercising with their preschool children at home, an increase in the variety of foods consumed and a decrease in the consumption of fat. This study demonstrated that health related behaviors could be changed in a time frame of a school year.

Koblinsky and Phillips (1987) reported on the Volunteer Nutrition Consultants in the Head Start program. Ninety-nine percent of Head Start directors surveyed requested continuing services from a Volunteer Nutrition Consultant. Head Start personnel also emphasized the valuable contributions that the volunteers have made in helping Head Start families improve their meal planning, grocery shopping, food preparation and eating habits. These volunteers consist of home economists, nutritionists, dietitians, early childhood educators and teachers.

More recently Koblinsky, Guthrie and Lynch (1992) studied a Head Start nutrition education program for Head Start mothers consisting of thirteen newsletters, and four nutrition workshops. She discovered that the women involved in the program in Maryland gave their children a more diverse and high quality diet and more servings of selected nutritious foods than the children in the control group. These findings indicate that nutrition education programs for parents can lead to improvements in the diets of children who were eating fewer

than the recommended servings of nutritious foods and thus could improve nutritional status.

Effect of preschool nutrition education on health status of children

Anemia, obesity, dental caries, prevention of heart disease and growth retardation are nutritional concerns of preschoolers to which society should attend. St Pierre (1982) states that "it is easier for a nutrition education program to teach children nutrition-related knowledge than to change their health status". He explains that the achievement of long-range goals may not be measurable after a short-term program. For example, a highly valued long-range outcome of a nutrition education program is improved health status. However after a typical ten week nutrition education program, an evaluation that looked only for changes in health status would be unfair.

Malnutrition in the preschool child has been one of the most serious and challenging health problems in the developing countries. Many of the nutrition education programs in developing countries have a supplement component. The use of a food supplement is important in making changes in behavior as well as combating malnutrition. In the United States meals and snacks are often an integral part of the nutrition education program (ie., Head Start).

Ekeh (1985) studied 152 children in Nigeria who attended well baby clinics. Ten percent of mothers were sampled on clinic days for four consecutive days. The children's ages ranged from one to forty-eight months. The mothers attending the clinic were consistently exposed to health education activities. Prior to the awareness to intensify the health education program in these two clinics, records and surveys indicated that the weight of the children from the low-income group, especially the preschoolers, were below standard. Weight for age was chosen as the parameter for assessing nutritional status. When analyzing the weight for age data, Ekeh (1985) observed that the health and nutrition education intervention has decreased the incidence and severity of malnutrition.

Jansen and Verkley (1986) looked at the effect of a food supplement (whole maize flour, dried skimmed milk and maize oil) and nutrition education of mothers on protein-energy malnutrition (PEM) of their children in Kenya. Fifty-three children were part of the intervention group and the mean age was 22.8 months. These children were seen every four weeks for 24 weeks at the clinic or at home. At the clinic a food demonstration and health/nutrition education talk, and supplemental food were given. The comparison group consisted of 65 children and their mean age was 24.9 months. The intervention lasted 24 weeks and both groups of children were evaluated at 24 and 40 weeks. They found no significant difference between the children's growth and energy intake between the intervention and comparison groups. This may have occurred because the food supplement was not always given to the child in the program and if the supplement were provided to them, then other food was withheld at home.

An effective food supplement (milk) and nutrition education program was conducted by

Dutra De Oliveira et. al. (1980) in Brazil. Three hundred sixty-eight individual-housed low socioeconomic level families in a periurban area of the town of Ribeiroa were studied. Only families with children two to six years old were invited to participate in the program. Two hundred fifty-five children entered the study and 139 completed (95% moved from the area). The intervention lasted for nine months and consisted of monthly nutrition education classes for mothers and weekly nutrition education classes for the children over four years of age. The children received at no cost two 200 ml. glasses of milk a day at one of six small stores in the area. The children had a better attendance record at the nutrition classes than the mothers. A significant positive correlation was found between the presence of mothers and children at the classes and the total children's attendance at the drinking centers which were separate from the classes. Another successful component of this study was that the children drank the milk at the store ensuring that the children aged two to six received the milk.

Another effective nutrition education and feeding program was conducted in Bangladesh by Stanton et. al. (1987). Eighty-two children from 18 months to 48 months suffering from moderate to severe malnutrition were given three meals and two snacks daily for five weeks. The mothers were given daily nutrition lessons and demonstrations. After five weeks of these interventions there was an increase in the rate of weight gain above the expected rate. This trend continued at six and ten months after the program was completed.

Lomparis (1991) collected food expenditure data, children's height and weight, and demographic data of 280 families and 421 preschool age children participating in a maternal and child health program in Cali, Columbia. She concluded that simply teaching third world mothers to read holds the greatest promise for permanently improving the nutritional well being of their preschool children.

Smith et. al. (1986) looked at the effect of individual counseling, nutrition education classes, and WIC food vouchers on the hemoglobin levels in fifty anemic children. They observed that the mothers who participated in the program had an increase in nutrition knowledge as well as a significantly greater increase in their child's hemoglobin levels. From this study it was apparent that nutrition education classes increased nutrition knowledge, but it was hard to determine the magnitude of each intervention on the increase on hemoglobin levels. Zeitlin and Formacion (1981) found that most of the evidence that nutrition education is effective in improving nutritional status is indirect because its impact is difficult to separate from that of other services and health care in particular.

Summary

There are several reported methods of conducting preschool nutrition education programs: preschool nutrition education curriculum in preschool and day care settings (stories, books, cassettes, videos, cooking, field trips, special visitors, games, posters, discussions, computer lessons, tasting parties, songs, puzzles, art projects, role playing, skits

and puppets), curriculum for home setting, nutrition education programs for parents of preschool children (newsletters, workshops, small group meetings and food fairs), training of teachers and other caregivers, and behavioral interventions on food preferences. Each of these methods has been effective in changing nutrition knowledge. The evidence has not been conclusive on food and nutrition behavior and health status.

CONCLUSIONS

Parental Involvement

Parental involvement is probably the most important component in the success of a nutrition education program for preschoolers. Whether the parent is the major recipient of the program or is presented the program in conjunction with the child; the parent's involvement is essential for success. If the parent's interest in nutrition is heightened as the child becomes acquainted with a wide variety of foods and the good eating habits learned at preschool, this behavior has a better chance of being continued at home. When parents and teachers work together the nutrition education experience is more meaningful through mutual reinforcement. As we have seen, educating and encouraging the parent's participation is a very effective tool for increasing a child's nutrition knowledge as well as for promoting more healthful eating habits. Families are a major source in determining whether or not children learn successfully and they exert a strong influence on a child's diet.

Developmentally Appropriate Programs

Another key factor in having a successful nutrition education program is to create and use developmentally appropriate learning experiences for children. Gorelick and Clark (1985) found that when developmentally appropriate materials are used in a classroom nutrition education program they can be effectively implemented with children as young as three to five years. Many nutrition education curricula in the past contained tasks that required too high a level of cognitive ability. Contento (1981), Gorelick and Clark (1985), Herr and Morse (1989), Hertzler (1994), and Smith (1989) report that understanding the developmental levels of young children is critical in planning effective learning activities. Piagetian theory suggests that no amount of teaching will make children learn concepts which are beyond the capability of their cognitive structures to understand. In order for nutrition programs for preschool children to be effective they need to be tailored to the children's developmental skills.

Activity-Based Programs

The preschool aged child learns by physical manipulation of the environment. Piagetian research (Contento 1981) has shown that activity-based teaching and teaching strategies that encourage interaction with real world objects is effective for this age group. Olson and Randell (1981) reported that activities that offer children first-hand experience, active participation and a non-threatening environment have been successful. Byrd-Brenbenner, Marecic and Bernstein (1993), Community Research Center (1980), Davis et. al. (1983), Hertzler (1990), Phillips (1983) and Turner and Evers (1987) have found that activity-based programs have

been effective in increasing nutrition knowledge and changing food habits. Effective activity based learning includes art projects, visitors to class, cloth food models, songs, jingles, role playing, games, field trips, magic tricks, dramatic presentations, stories, puppets, pictures and felt boards, puzzles, and computer lessons.

Food-Based Programs

Food-based activities such as vegetable and fruit gardens, food preparation, tasting parties, engaging the five senses with food, and eating healthy meals and snacks with peers and adult role models have been successful in increasing children's food preferences. Battle and Blackwell (1981), Berenbaum (1986), Briley and Roberts-Gray (1994), Bryd-Bredbenner, Marecic and Bernstein (1993), Phillips (1983), and Head Start nutrition educators (U.S. Dept. H.H.S. 1992) have found that food experiences are one of the best ways to teach children about food and nutrition. Meal and snack times at preschools and child care centers are important and effective tools for making positive changes in children's eating habits and behaviors. Briley and Roberts-Gray state, "One of the most promising strategies for effecting positive change in nutrition habits is to ensure that meals at child care centers are used as a *centerpiece* of nutrition education programs that reinforce healthful habits". Birch and her associates' research (1980, 1982, 1984,1987, and 1994) reinforces the effectiveness of food-based activities on forming and changing children's eating habits and behavior. Birch (1987) has found that experience plays a major role in children's food acceptance patterns. She has found that preference for a food was an increasing function of tasting and looking. Besides frequency of exposure to a food, the social context in which food is presented also influences the formation of food preferences and eating behaviors. A child's preference for a food can be enhanced when exposed to peer models who have different preferences from those of the observing child (Birch 1980) and when foods are presented in the reward component of a contingency. However, when a food is eaten as a means to obtain a reward, decrements in preference are noted (Birch, Marlin and Rotter 1984 and Birch 1987).

Other Essential Factors for Effective Preschool Nutrition Education Programs

It has been found that nutrition education will be more utilized if it becomes integrated into the early childhood curriculum (Herr and Morse 1989). Nutrition education activities can be integrated into sensory development, language arts, science, dramatic play, art, music, fine and gross motor development and social studies. Nutrition curricula need to be easy to understand, affordable, and necessary materials should be easily available and affordable.

Another important aspect of effective nutrition education for preschool age children is that the staff be adequately trained. When Phillips (1983) evaluated the nutrition education component of Head Start programs she found it was effective to develop an on-going nutrition

education program for staff members. Olson and Randell (1981) commented that, "Staff training is an important prerequisite for a nutrition education program to be successful".

SUMMARY OF FINDINGS

Parental involvement is one of the most important components for a successful preschool nutrition education program. Another necessary factor for success is that the program be developmentally appropriate. Activity-based and food-based activities have been very effective in making changes in the children's nutrition knowledge and eating habits. Having programs that involve parents, are developmentally appropriate, give children the opportunity to be physically involved, and involve food will definitely increase the success of any nutrition education program for children.

IMPLICATIONS FOR POLICY, RESEARCH AND PROGRAM IMPLEMENTATION

Need for Evaluation of Curriculum and Nutrition Education Materials for Preschool Children

In the past fifteen years we have seen the development of many nutrition education curricula for preschool children. Many of these materials have been field tested for use with preschool children but they have not been evaluated for their effectiveness of increasing nutrition knowledge, changing nutrition attitudes or changing eating habits. Often the major attention is given to the development and the implementation of a new program and the evaluation receives a small amount of money, time and staffing. Evaluations need to be an integral part of each program.

We need staff to understand the importance of evaluating a program and see that evaluation is an essential part of a program, not just an afterthought or a way to create more work or a threat to their ability to do their job. Without evaluations one will never know what works and what does not work. Each lesson in the Head Start Education Curriculum, *Children, Get A Head Start On the Road to Good Nutrition*, has a technique for immediately measuring what a child has learned and determines whether the goals have been met. We need to see more of this type of evaluation in the other curricula that have been and are being developed.

Longer Time Frames and Longitudinal Studies

Byrd-Bredbenner, Marecic and Bernstein (1993) and Kalina, Phillips and Minns (1989) each concluded that the programs that they evaluated needed to be conducted for longer periods of time in order to be seen as effective. Byrd-Bredbenner, Marecic and Bernstein (1993) developed a curriculum for a three year period but it was only tested for six weeks because of funding constraints. Projects need to be funded so they can be conducted in the time frame for which they had been designed. This allows for the children to have time to internalize the concepts and have them become incorporated into their nutritional attitudes and eating behaviors.

Longitudinal studies need to be done on the long term effects of nutrition education programs for preschool children. University-based centers that have worked with these children from infancy to kindergarten would be excellent places in which to do some longitudinal studies. When these children are in the third grade they could be interviewed on their nutritional knowledge, nutrition attitude and eating habits. They could be compared with children who did not attend preschool or a preschool without a nutrition component. Longitudinal studies are desirable because a change in behavior usually occurs slowly and would more likely to be detected when evaluated in this manner. If there are no long term effects, than we need to change our approaches and design programs that have lasting effects and produce positive changes in eating habits and nutritional status.

Further Research on the Effects of Nutrition Attitudes and Knowledge on Eating Habits

There is a need for additional research on the effect of nutrition attitudes of preschoolers on their actual food practices. More studies are needed to determine whether young children can apply their nutrition knowledge to everyday nutrition practices. Hertzler (1990) stated that, "It is widely recognized that a knowledge of names and functions does not indicate an ability to select a nutritionally appropriate diet". She suggests that we develop classroom materials and activities that include problem solving skills. Mary Goodwin (1994) believes that giving children choices instead of telling them what to do is a more effective approach. She believes that children need to think about choices and express themselves. Birch (1980, 1987 and 1994), Birch and Marlin (1982) and Birch, Marlin, and Rotter (1984) have conducted extensive research in the area of food preferences, peer modeling, and associative conditioning. More information is needed to assist us in what needs to be taught in nutrition education programs for preschool age children that will affect and cause the desired behavioral changes for eating a healthy diet.

Further Study of Families and Children At Risk

The majority of the research has concentrated on the role of the mother on the child's nutrition education and eating behavior. More research should be done on the role of the father, older siblings, grandparents and other involved extended family. Understanding their role and influence on the child will help with the design of future programs in terms of content and target audience.

Another important consideration is studying the child from marginally functional or dysfunctional families. It has been found that dysfunctional families appear to have difficulty in assimilating food and nutrition information into food habits (Hertzler 1983). These families are often characterized as having many problems such as low or unsteady income, lower parental education, poorer housing, poorer food habits, and more primitive concepts of health and nutrition. Such families are described as living for today and not for the future and to be least likely to change (Hertzler 1983). Mary Goodwin (1994), based on many years of extensive work in nutrition education with children, believes that we need to concentrate more on children coming from these kinds of families where there is no routine with feeding and the child eats what she or he wants. Often the child feels less secure and is less likely to try new foods. Many of these children may not even be enrolled in programs like Head Start and may be very hard to reach. Perhaps television shows, PSAs and programs in supermarkets maybe the way to reach them as described in the following sections.

New and Different Approaches

Television shows and public service announcements

When the author of this paper conducted a mass media nutrition education campaign

with community outreach to decrease the incidence of developmental disabilities in South Central Los Angeles, she found that television was the most preferred method of learning about nutrition (Sharaga 1975). Television shows are an excellent vehicle to convey positive messages about good snacks, healthy eating, and the relationship of food and health. Bandura has provided us with the theory of observational learning. Observational learning or learning through imitation is assumed to account for a great deal of significant social learning (Lefrancois 1983). Bandura, Ross and Ross (1963) studied nursery school children's response to watching aggressive behavior and nonaggressive behavior of an adult model, film of an adult model, and a cartoon character. The children tended to model the behavior to which they were exposed. They concluded that watching the model affected behavior. The use of adult models, child models, and cartoon characters will have an effect on children. Programs on the cable and major networks need to communicate nutrition messages that we would like young children to imitate. This can be accomplished by contacting the writers and producers of the programs. In addition this will help them to increase the educational value of their shows as well as their community service.

Public service announcements (PSAs) are another effective method to communicate good nutrition ideas. Galst (1980) studied the effect of television food commercials and pro-nutritional public service announcements on sixty-five preschool age children ranging in age from 3.5 to 6.75 years during a four week period. She found that the intervention which was most effective in reducing young children's selection of snacks with added sugar content was the presentation of commercials for food products without added sugar and pro-nutritional public service announcements with accompanying positive evaluative comments by an adult co-observer. However without the inclusion of the adult commentator there was no difference in the children's snacking behavior between the children exposed to commercials promoting snacks high in sugar than to children exposed to the commercials promoting snacks without added sugar. Presently KIDSNET with funding from the FDA is producing spots which will teach about the new food label and try to motivate children from four to ten years to make good food choices, as well as producing printed materials for parents and educators. This program of KIDSNET follows the principles of Galst's work since they are including adult co-observers (parents and educators) to reinforce the message of their PSA. Perhaps a KIDSNET program communicating simpler concepts would be more appropriate for children from two to five years of age. Since March 1994, CBS, McDonald's, and the Society for Nutrition Education have been running spots, *What's On Your Plate*, (targeted for two to eleven year olds) on children's television on Saturday mornings on CBS. The video of these PSAs is available and includes a kit for educators and health professionals. More of these PSAs need to be produced and aired to combat the barrage of ads for sweet, fatty, and salty foods on *Kid Vid.* Further recommendations on PSAs can be made after KIDSNET and McDonald's/Society for Nutrition Education programs are evaluated.

Supermarkets

As previously mentioned by Coletta and Farris (in Hertzler 1990), children listed the

grocery store as a major source of nutrition information. Hertzler (1990) cites Eppright's finding that approximately half of the preschoolers shopped with their mothers on every trip to the supermarket. Further research needs to be conducted on the nutritional education process that occurs in the supermarket. The existing displays of Joe Camel, big moving cans of Coors, and large stuffed dogs for dog food definitely gets the attention of preschool children as they shop with their parents. Setting up nutritional displays in food stores would be an excellent way to reach preschoolers and their families. Large models of food, food samples, coupons, and colorful educational materials would be effective ways to communicate about healthy foods and they would especially be beneficial at the place of purchase. Government agencies and private industry could have traveling exhibits to emphasize eating the *Food Guide Pyramid* way.

Toys, games and puzzles

Another way we can provide nutrition education through private business is to produce toys that express a positive nutrition message. Puzzles can be made of healthy foods and snacks. Food bingo with good food choices, lotto, dominoes, and the *Food Guide Pyramid* can be sold as regular toys, not just as education materials for nutrition educators. Perhaps a game of *Vegetableland* instead of *Candyland* would give vegetables a better image. The plastic foods sold for play kitchens could be more of nutritious choices and less empty-calorie foods. Coloring and activity books could be sold that contain positive nutrition messages that pertain to preschool age children and their families. Stickers, placements, dishes and utensils could be designed displaying healthy foods and snacks.

Computer programs

Computers have an incredible potential for the delivery of interactive and individualized instruction, a technology for motivating and interesting children in learning and a medium for the creation of environments that encourage inductive or experiential learning (Lepper and Milojkovic 1986). Computers used in preschool nutrition education has many advantages such as interactivity of learning, individualization of learning, immediacy of response, and independence of learning. In addition to its technical capabilities, they provide opportunity for enhancing four primary determinants of intrinsic motivation: challenge, curiosity, control and fantasy (Lepper and Milajkovic 1986). Preschool age children can learn about nutrition by using interactive CD-ROMS and other software. They can go on shopping trips, order in restaurants and fast-food places, plan menus, and make food choices for snacks and meals. After checking with several computer software companies in the United States it appears that there are not any CD-ROMS on food and nutrition for preschool age children. These interactive programs could make an excellent tool for pretesting and posttesting children when evaluating a nutrition education program, as well as teaching nutrition at preschools, home, health fairs and health clinics.

Summary

The most important recommendation is to evaluate the existing nutrition education programs and materials for increasing nutrition knowledge, changing nutrition attitudes and improving eating habits and nutritional status. More funding needs to be devoted to evaluating, and evaluations should become an integral part of these programs. Studies should be conducted for longer periods of time to obtain a better measure of the effectiveness of the interventions. The father, grandparents, and older siblings need to be involved as well as the mother in the interventions and research. New and different approaches need to be designed and tested.

Food preferences or food acceptance patterns are largely determined by experience with food and social learning. Taste is shaped by experience and exposure at home, preschool, and other social situations. Young children want to learn about food, nutrition and health. We must take this responsibility seriously by creating effective ways to teach children and give them the experiences they need to acquire the preferences for nutritious, wholesome foods. We need to create positive attitudes toward food, encourage acceptance of a variety of foods, promote an understanding of the relationships between food and health, and foster the development of healthy food habits in children. Government and private industry must join forces to address these issues.

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APPENDIX A

SUMMARY OF STUDIES

Author & year	# of subjects	Setting	Design & measures	Intervention	Length of Intervention	Results
Birch & Marlin 1980	39	nursery school	pretest/posttest food preferences	peer modeling	9 weeks	Targets changed preferences to nonpreferred choices.
Community Research Center 1980	168	child care facilities	pretest/posttest treatment/control food preferences	activity- & food-based activities	7 months	Increased preference of fruits, vegetables and dairy products.
Dutra De Oliveira et. al. 1980	139	housing tract	treatment group measured impact of program	classes & milk supplement	9 months	Positive correlation with class attendance of mothers and children with consumption of free milk at local stores.
Galst , J.P. 1980	65	nursery school	pretest/posttest 4 treatment gps. & 1 control, snack preferences	TV ads, PSAs, and adult commentator	4 weeks	Decreased intake of snacks with added sugar in children exposed to TV ads for low sugar snacks, pro-nutritional PSAs and adult commentator.
Contento, I. 1981	34	naturalistic setting	studied difference between pre-operational & concrete operational stage, knowledge	stage of development	----------	Both groups of children believe that food remains the same once is it cut. Preoperational children believe food does not change in the body. But concrete operational children understood that food is changed in the body. Almost all children choose less nutritious snack after the inter-view.
Birch, L.L. 1982	14	preschool	posttest, 5 treat-ment gps. food preferences	2, 5, 10, 15, or 20 exposures to novel foods	6 weeks	Preference is an increasing function of exposure.

Author & year	# of subjects	Setting	Design & measures	Intervention	Length of intervention	Results
Hunsley, E. 1982	850	day care & preschool	pretest/posttest treatment & control food preferences	activity- & food-based activities	varied at each site	No statistical difference between treatment and control group.
Davis et. al. 1983	16 centers	preschool, day care centers & homes	pretest/posttest no control knowledge & food preferences	activity- & food-based activities	6 weeks	Increased knowledge of food sources and nutrient functions.
Birch et. al. 1984	45	preschool	pretest/posttest 4 treatment & 2 control gps. food preferences	children consumed a beverage to get a reward	6 weeks	Found a significant negative shift in preference for the 4 instrumental groups and the control groups showed a slight but not significant increase in preference.
Lee et. al. 1984	60	lab & home	pretest/posttest 2 treatment gps. & 1 control gp. knowledge	concept-based program in school or at home	8 weeks	Children taught at school learned significantly better than those taught at home.
Leonard et. al. 1984	36 families	parents met in small gps.	pretest/posttest treatment & control, attitude	parents met group leaders	5 weeks	Decreased use of negative verbalizations by the parents at mealtime and improved verbal responses by fathers to food situations.
Ekeh, H. 1985	152	well baby clinic	pretest/posttest weight for age	health & nutrition education activities	--------	Decreased incidence and severity of malnutrition.
Gorelick & Clark 1985	187	preschool	pretest/posttest treatment & control knowledge	activity- & food-based activities	6 weeks	Significant improvement in food and nutrition knowledge.

Author & year	# of subjects	Setting	Design & measures	Interventions	Length of intervention	Results
Gunn & Stevenson 1985	95 parents	Head Start	pretest/posttest eating habits & exercising with their children	workshops lectures, news-letters, festival & exercise activities	9 months	Increase in parents exercising with their children.. Increased variety of food consumed by family and decreased intake of fat.
Jansen & Verkley 1986	118	home or clinic	treatment & control, nutri-tional status	nutrition talk, food demonstrations & food supplement	20 months	No difference between treatment group and control in nutritional status.
Stark et. al. 1986	17	preschool & home	pretest/posttest food preferences for snacks	cueing and contingent rewards for choosing a healthy snack	65 days	Rewards increased healthy snack choices just at school. After withdrawal of rewards, snack choices went back to baseline levels.
Smith A. et. al. 1986	50	WIC clinic	pretest/posttest treatment & control, anemia & knowledge	nutrition classes, counseling & food vouchers	6 months	WIC mothers had increase in nutrition knowledge and significantly greater increase in their child's hemoglobin level.
Stanton et. al 1987	82	health clinic	pretest/posttest weight gain	nutrition &. cooking classes, fed 3 meals & 2 snacks	5 weeks	Increase in weight gain above expected rate.
Turner & Evers 1987	55	preschool	pretest/posttest treatment & control gps, nutrition knowledge	nutrition lesson with computer or puppets	1 lesson	The two methods produced the same results. Nutrition knowledge increased with the computer lesson and the lesson with puppets.

Author & year	# of subjects	Setting	Design & measures	Intervention	Length of Intervention	Results
Essa et. al. 1988	60	day care center & home	pretest/posttest 2 treatment gps. & a control gp knowledge.	nutrition classes at school with parent involvement at home	10 weeks	Children exposed to curriculum at school with parent component at home had greatest increase in nutrition knowledge. Children taught curriculum at school only scored higher than control group
Hendricks et. al. 1989	267	preschool	pretest/posttest treatment & control gp. health knowledge	Hale and Hardy's Healthful Hints curriculum	7 months	Increased children's knowledge of health and nutrition.
Anliker et. al. 1990	104	growth study	correl. between parent's messages & child's nutrition knowledge	parent's messages about food & nutrition	age of child	The quantity and specificity of parents' nutrition-related messages were significantly and positively related to children's nutrition knowledge scores.
Lawatsch, D.E. 1990	103	preschool	pretest/posttest 2 treatment gps. & a control gp. food preference, attitude and knowledge	fairy tales with *benefit* or *threat* appeal regarding vegetables	3 days	Both treatment groups had higher nutrition knowledge scores but the *benefit* group had the highest nutrition knowledge score and higher score for vegetable snacks chosen.
Kleges, R. 1991	53	lab & cafeteria	measured ht. & wt. of children & mothers, observed food selection of child & mother	child selects own food & mother modifies child's selection	1 day	Children given free choice choose tray with foods high in sugar. When child know mother would see tray, child choose less foods high in sugar. Mothers decreased the child's intake of calories, saturated fat, and sodium.

Author & year	# of subjects	Setting	Design & measures	Intervention	Length of intervention	Results
Lomparis, A. 1991	421	health program	collect data and look at correl. with nutrition status	----------	collect data for 2 years	Concluded that teaching third mothers to read holds the greatest promise for permanently improving the nutritional status of their preschool children.
Koblinsky et al. 1992	171 mothers	Head Start	pretest/posttest treatment gp. & control gp. food intake	newsletters & workshops	13 weeks	Children whose mothers' received nutrition education, had a more , diverse diet with high quality, and more servings of nutritious foods than children in control group.
Singleton et. al. 1992	60	home	pretest/posttest treatment & control gp. measured health perception & role of food	8 autotutorial lessons in auto-cassette book format for use at home	4 weeks	Nutrition education significantly increased children's perception that health and nutrition were related concepts.
Byrd Bredbenner, C. 1993	1000	Head Start	pretest/posttest treatment & control gp measured nutrition knowledge, attitudes and food preferences	activity- & food-based activities	6 weeks	There was no significant difference in nutrition knowledge and attitude. The children exposed to the curriculum decreased their refusal of foods served at Head Start and increased their requests for low-sugar snacks.

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